Scoping Suggestions for the Risk of Air Pollution Associated with Vessel Traffic

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1. The base problem and the need for a cumulative view

Around 11,000 large vessels and oil barges, and accompanying tugs, transit through the Salish Sea each year. Some 4,300 of these large vessels are destined for United States' ports in Puget Sound. The other 6,250 make for Canadian ports.[1] The proposed Gateway Pacific Terminal (GPT) will add approximately 440 ship transits per year, equating to a 4% increase to the 2011 traffic once the terminal becomes operational. After it becomes fully operational, the GPT is projected to generate an additional increase of about 950 transits per year, or an increase of 9%, within 15 years.[2] This increase will be over and above other future expansion in other shipping operations. Each of these vessels presents a risk of increasing air pollution in the region. To assess this risk it is necessary that the additional vessels, in addition to all of the existing related vessels, be assessed for both their incremental and cumulative air pollution, especially in light of the high standards that the governments of the United States and Canada are trying to achieve in this area. Only this type of evaluation will reveal the true extent of the significant risk of air pollution at hand. A cumulative assessment is essential as it will reveal risks that, while perhaps appearing to be minor on an individual level, once quantified in a cumulative assessment framework, may actually turn out to be highly relevant contributors to the risk profile when placed in the context of the overall risk to the air quality of the greater Puget Sound/Georgia Strait area.[3]

In addition to the past, present and the currently proposed 8% increases in shipping traffic for the GPT development, the cumulative assessment should also scope the likely future additional expansions of vessel traffic in this area (even if they are not yet formal or approved proposals). This requirement is especially important when dealing with inter-related projects that will all utilize the same limited resource, in this case, shipping routes. That is, a forward projected assessment should also include data in the cumulative equation on air pollution from traffic increases that can reasonably be foreseen including general increases in vessel traffic from other sources and also vessel traffic projections for other proposed major developments (including those in Canada) that will need to use the same shipping route. This will greatly assist the authorities in providing the necessary information to achieve

[1] Hass, T. (2012). The Vessel Traffic Risk Assessment for BP Cherry Point and Maritime Risk Management in Puget Sound. (Puget Sound Partnership). 5.

[2] Pacific International Terminals, Inc. (2011). Project Information Document, Gateway Pacific Terminal, Whatcom County, Washington. 304 p. Also, Vessel Entries and Transits: 2011 WDOE Publication 12-08-003 April 2012.

[3] Kern v. United States Bureau of Land Mgmt., 284 F.3d 1062, 1075 (9th Cir. 2002).

meaningful regional planning at a reasonable cost, in which uncertainties can be evaluated and effective, appropriate, and sustainable economic, social and environmental choices can be made.[4]

2. The reasonably foreseeable risk of vessel based air pollution

Studies assessing the potential impacts of international shipping on climate and air pollution demonstrate that ships contribute significantly to global climate change and health impacts through emission of GHGs (for example, carbon dioxide [CO2], methane [CH4], chlorofluorocarbons [CFC]), aerosols, nitrogen oxides (NOx), sulfur oxides (SOx), carbon monoxide (CO) and particulate matter (PM). Air quality impacts may result from the chemical processing and atmospheric transport of ship emissions. For example, NOx emissions from ships can combine with hydrocarbons in the presence of sunlight to produce ozone pollution, which can potentially affect visibility through haze, human and environmental health and has been associated with climate change effects. All classes of ocean-going marine vessels equipped with engines have the capacity to cause air pollution. Because more than 50% of a ship's operating expense is generally the cost of fuel oil, most of the world's ship operators seek the cheapest fuels available; in which high levels of pollutants is the price of their cheaper cost rather than cleaner alternatives. Accordingly, the diesel engines that power the vessels are often significant mobile source emitters of pollution in terms of sulphur oxides, fine particulate matter, nitrous oxides and resultant low level ozone.

[4] Zhao, M. (2012). 'Barriers and Opportunities for Effective Cumulative Impact Assessment within State-Level Environmental Review Frameworks in the United States'. Journal of Environmental Planning and Management. 55(7): 961-978. Senner, R. (2011). 'Appraising the Sustainability of Project Alternatives: An Increasing Role for Cumulative Impact Assessment'. Environmental Impact Assessment Review. 31: 502-505. Hegmann, G. (2011). 'Alchemy to Reason: Effective Use of Cumulative Effects Assessment in Resource Management'. 31 Environmental Impact Assessment Review. 31: 484-490. Gunn, J. (2011). 'Conceptual and Methodological Challenges to Cumulative Effects Assessment'. *Environmental Impact Assessment Review*. 31: 154-160. Therivel, R. (2007). 'Cumulative Effects Assessment: Does Scale Matter ?' *Environmental Impact Assessment Review*. 27: 365-385. Burris, R. (1997). 'Facilitating Cumulative Impact Assessment in the EIA Process'. *International Journal of Environmental Studies*. 53: 1-2, 11-29. Thatcher, T. (1990). 'Understanding Interdependence in the Natural Environment: Some Thoughts on Cumulative Impact Assessment Under the National Environmental Policy Act'. *Environmental Law*. 20: 611. Eckberg, D. (1986). 'Cumulative Impacts Under NEPA'.*Environmental Law*. 16: 673. http://www.aleutiansriskassessment.com/passing.htm

Given that many of these vessels are international in origin, they are not bound by national standards that impose restrictions upon similar technologies on the lands that they visit.[5]

Many of the worst air pollution spots in the United States (including 30 ports), in terms of low-level ozone and fine particulate matter, are attributed to the pollution from ships.[6] Without restraint, projections suggest that by 2030 emissions of nitrogen oxides from ships would more than double, growing to 2.1 million tons a year while annual emissions of fine particulate matter would almost triple to 170,000 tons. Within the shared air-corridor of the Georgia Basin-Puget Sound between the United States and Canada the annual emissions from shipping were estimated at 24,500 tons of sulpher dioxide, 86,500 tons of nitrous oxide and 4,000 tons of fine particulate matter. If unrestrained growth was permitted, projections suggested that, by 2015, marine vessels in this region would contribute 37% of the total air budget of sulpher dioxide, 22% of the nitrous oxide, and 16% of the fine particulate matter.[7]

If not controlled, the impacts of this pollution estimated for the year 2020, is as many as 14,000 premature deaths and related respiratory difficulties for nearly five million people each year in the United States and Canada. The monetized health-related benefits are estimated to be as much as $110 billion in the United States alone.[8]

3. Indicators of significant risk

The contribution that ocean going vessels contribute to air pollution in North America, and the US-Canadian trans-boundary regime, which includes the United States-Canada Border Air Quality Strategy and its flagship program which is the Georgia Basin Puget Sound

[5] Han, C (2010). 'Strategies to Reduce Air Pollution in Shipping Industry'. *The Asian Journal of Shipping and Logistics.* 26(1): 7-30.

[6] Environment Canada (2005). Marine Vessels Emissions Survey. (EC, Vancouver). 2. Bailey, D. (2004). 'Pollution Prevention at Ports: Clearing the Air'. *Environmental Impact Assessment Review*. 24: 749–774

[7] McLaren, R. (2011). 'A Survey of NO2:SO2 Emission Ratios Measured in Marine Vessel Plumes in the Strait of Georgia'. *Atmospheric Environment* 46: 655-58. BMT Fleet Technology. (2005). Management Options for Marine Vessel Air Emissions (Ontario).

[8] See Schinas, O (2010). 'Cost Assessment of Environmental Regulation and Options for Marine Operators'. Transportation Research Part C 25: 81–99. Winebrake, J. (2009). 'Mitigating the Health Impacts of Pollution from Oceangoing Shipping: An Assessment of Low-Sulfur Fuel Mandates'. *Environmental Science and Technology*. 43(13): 4776-4785. Gallagher, K. (2005). 'International Trade and Air Pollution: Estimating the Economic Costs of Air Emissions from Waterborne Commerce Vessels in the United States'. *Journal of Environmental Management* 77: 99–103. For the 2020 figures, see a.gov/otaq/regs/nonroad/marine/ci/420f10015.pdf

International Airshed Strategy, provided the impetus for both governments to approach the IMO to manage, collectively and internationally, vessel based air pollution around North America.[9]

The IMO, conscious that vessels under their auspice (above 400 tons and trans-national) have been responsible for nearly 8% of global emissions of oxides of sulphur and a similar amount of nitrogen oxides, has been attempting to regulate this problem since the end of the 20th century.[10] Working through Annex IV (air pollution) to the 1973/1978 International Convention for the Prevention of Pollution from Ships (MARPOL), standards on both nitrogen and sulfur have been implemented. The standards on the oxides of nitrogen have been dealt with through ever increasing technical standards whereby emissions must be kept below levels which are tagged to the amount of revolutions per minute of different engine sizes, dependent on their date of manufacture.[11] Conversely, oxides of sulphur are dealt with by restricting the type of fuel oil that may be used on board ships. Specifically, the sulphur content of any fuel used on board ships shall not exceed a given amount of its total volume.[12] This figure, which originally started at 4.5%, has been progressively lowered to 3.5% in 2012, with the goal of reducing it to 0.5% in 2020 or 2025.[13] Unhappy with these limits, two regions have campaigned for the recognition of special Emission Control Areas (ECA) in which even higher standards are applied. The Baltic Sea and the North Sea have been designated emission control areas for sulphur pollution, by which the sulphur fuel content in the area cannot rise above 0.5% with a subsequent revision downwards to 0.1%.[14]

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[9] http://www.epa.gov/pugetsound/pdf/international_airshed_strategy.pdf Also, Fraser, D. (2006). 'Collaborative Science, Policy Development and Programme Implementation in the Transboundary Georgia Basin/Puget Sound Ecosystem'. *Environmental Monitoring and Assessment* 113: 49–69.

[10] Anon. (2006). 'New Pathway to Pollution in the Arctic'. *New Scientist*. July 22. 23. Anon. (2006). 'Clouds Gather Over Polluting Ships'. *New Scientist*. Feb 11. 21. Bond, M. (1996). 'Dirty Ships Evade Acid Rain Controls'. *New Scientist*. June 22. 8. Pearce, F. (1993). 'Britain Faces Huge Bill to Cut Acid Rain'. *New Scientist*. March 13. 4.

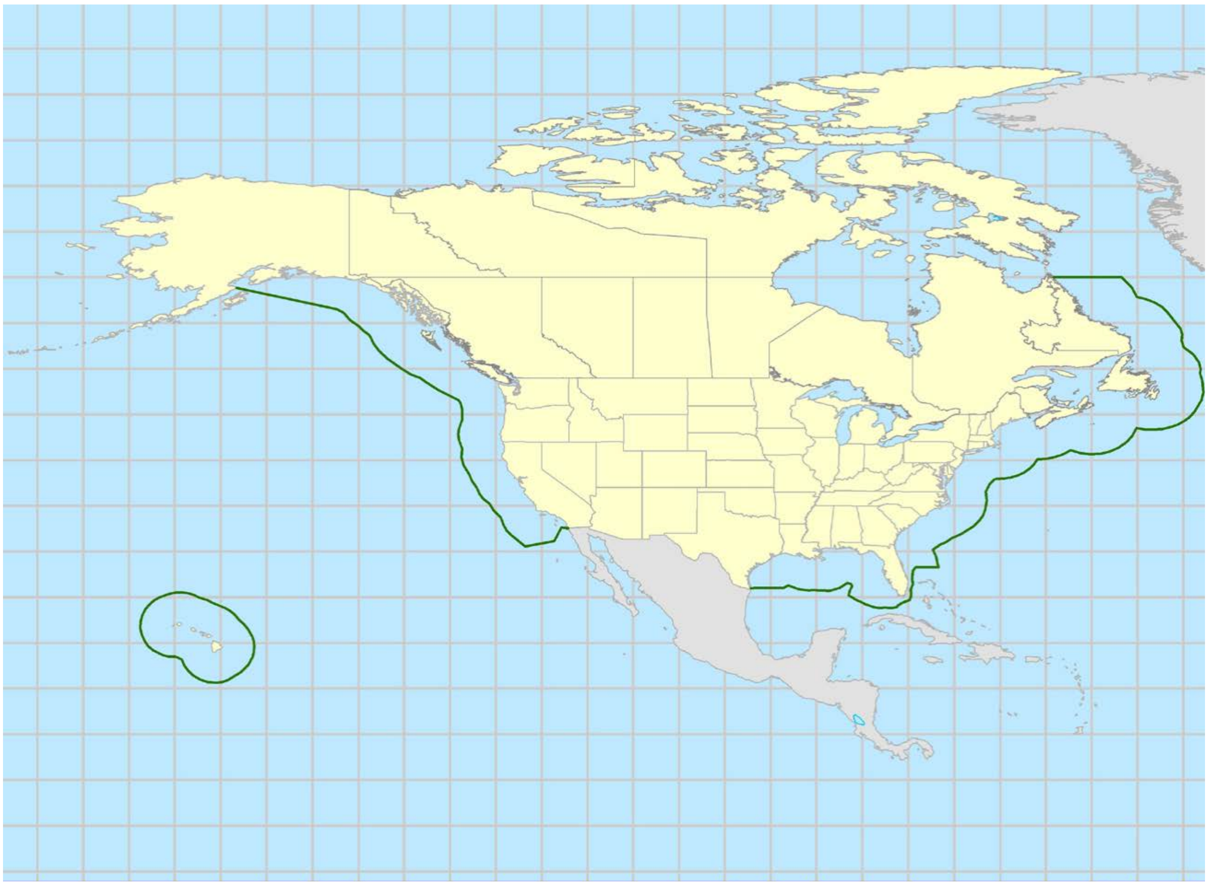
[11] See Regulation 13 of Annex VI of the 1973 International Convention for the Prevention of Pollution from Ships (MARPOL). This is reprinted in IMO (2003). MARPOL 73/78. (IMO, London). 408. Also, Anon. (2008). 'IMO Environment Meeting Approves Revised Regulations on Ship Emissions'. *IMO News*. 2: 7.

[12] See Regulation 14 of Annex VI. Ibid. 410.

[13] Anon. (2007). 'Marine Environment Protection Committee Progresses Key Issues'. IMO News. 2007 (3): 21. MEPC. (2004). Report of the MEPC on its 52nd Session. MEPC. 52/WP.13. 23.

[14] Matthias, V. (2010). 'The Contribution of Ship Emissions to Air Pollution in the North Sea Regions'. *Environmental Pollution* 158 (2010) 2241-2250. Anon. (2008). 'North Sea SECA Now In Effect'. IMO News. 2008 (1): 6. Annex 6. Availability and Use of Low Sulphur Bunker Fuel Oils in SOx Emission Control Areas Designated in Accordance With Regulation 14(3) of Annex VI of MARPOL. MEPC. Report of the MEPC on its 44th Session. MEPC 44/20 (2000). 58-60. This was later confirmed by the IMO in Resolution A.926 (22).

The United States and Canada then followed suit in an attempt to make the regulation of air pollution from such vessels of the highest possible standards.[15] In 2010, the IMO officially designated waters off North American coasts as an area in which stringent international emission standards will apply to ships. For this area, the effective date of the first-phase fuel sulfur standard is 2012 and the second phase begins in 2015. Beginning in 2016, high standards for the emission of nitrogen oxides also become applicable. The results of these standards are expected to be that by 2020, emissions from these ships operating in the North American ECA are expected to be reduced annually by 320,000 tons for oxides of nitrogen, 90,000 tons for fine particulate matter, and 920,000 tons for oxides of sulphur, which is 23%, 74%, and 86%, respectively, below predicted levels in 2020 absent the ECA.[16]



[15] Anon. (2009). 'US Coastal Clean Up'. *New Scientist*. April 4. 4.

[16] http://www.imo.org/mediacentre/pressbriefings/pages/28-eca.aspx. Also, Kotchenruther, R. (2013). 'A Regional Assessment of Marine Vessel PM2.5 Impacts in the U.S. Pacific Northwest'. *Atmospheric Environment* 68: 103-111. Tran, T. (2012). 'Potential Impacts of an Emission Control Area on Air Quality in Alaska Coastal Regions'. *Atmospheric Environment* 50 : 192-202

Figure 1: Area of the North American ECA[17]

4. Recommended research program

There is no need to study mitigations in this area, as mitigations have already been established and adopted, via the IMO, for the North American ECA. However, with the projected increases in traffic, it is possible that the benefits of the ECA may be offset by the growth of vessel traffic in this region. Accordingly, a study should be undertaken to see what impact of air pollution associated with increased vessel traffic, in the present and the reasonably foreseeable future, may have in this area and what impact these increases will have upon air quality standards.

[17] http://www.epa.gov/otaq/regs/nonroad/marine/ci/420f10015.pdf